



Spatial and temporal variation in PM_{2.5} chemical composition in the United States for health effects studies

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Abstract:

Background: Although numerous studies have demonstrated links between particulate matter (PM) and adverse health effects, the chemical components of the PM mixture that cause injury are unknown. **Objectives:** This work characterizes spatial and temporal variability of PM_{2.5} (PM with aerodynamic diameter < 2.5 µm) components in the United States; our objective is to identify components for assessment in epidemiologic studies. **Methods:** We constructed a database of 52 PM_{2.5} component concentrations for 187 U.S. counties for 2000-2005. First, we describe the challenges inherent to analysis of a national PM_{2.5} chemical composition database. Second, we identify components that contribute substantially to and/or co-vary with PM_{2.5} total mass. Third, we characterize the seasonal and regional variability of targeted components. **Results:** Strong seasonal and geographic variations in PM_{2.5} chemical composition are identified. Only seven of the 52 components contributed ≥ 1% to total mass for yearly or seasonal averages [ammonium (NH₄⁺), elemental carbon (EC), organic carbon matter (OCM), nitrate (NO₃⁻), silicon, sodium (Na⁺), and sulfate (SO₄²⁻)]. Strongest correlations with PM_{2.5} total mass were with NH₄⁺ (yearly), OCM (especially winter), NO₃⁻ (winter), and SO₄²⁻ (yearly, spring, autumn, and summer), with particularly strong correlations for NH₄⁺ and SO₄²⁻ in summer. Components that co-varied with PM_{2.5} total mass, based on daily detrended data, were NH₄⁺, SO₄²⁻, OCM, NO₃⁻, bromine, and EC. **Conclusions:** The subset of identified PM_{2.5} components should be investigated further to determine whether their daily variation is associated with daily variation of health indicators, and whether their seasonal and regional patterns can explain the seasonal and regional heterogeneity in PM₁₀ (PM with aerodynamic diameter < 10 µm) and PM_{2.5} health risks.

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Resource Description

Exposure : ☑

weather or climate related pathway by which climate change affects health

Air Pollution, Temperature

Air Pollution: Interaction with Temperature, Particulate Matter

Temperature: Fluctuations

Geographic Feature: ☑

Climate Change and Human Health Literature Portal

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

United States

Health Impact:

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Time Scale Unspecified